

SELECTED TOPICS In Aerospace Engineering

EDITOR

ERWIN SULAEMAN



IIUM Press

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011
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Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

ISBN: 978-967-418-145-1

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IIUM PRINTING SDN.BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan
Tel: **+603-6188 1542 / 44 / 45** Fax: **+603-6188 1543**
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IMPROVED DOUBLET LATTICE METHOD

28.1. Introduction

Numerical improvements of the double lattice method (DLM) are presented in this chapter. The improvements are applied to two types of lifting surface configurations, including the planar lifting surface and the non-planar lifting surface configurations. The numerical singularity problem of both configurations are first identified, and the solution procedures are described and compared with the original solution of Albano and Rodden [2] and with its refinement solution proposed by Rodden, Giesing and Kalman [30].

28.2. Present DLM for Planar Lifting Surfaces

The basic concepts of the original DLM are used here. The surfaces are divided into small trapezoidal elements as shown in Fig. 33.1. The lifting pressure is assumed to be concentrated at the doublet lifting line located at the quarter chord of each panel. The control point is placed on the three-quarter chord at mid-span of each element.

If the doublet lifting line and the control point are located at elements i and j respectively, then the aerodynamic operator may be written as:

$$\mathfrak{V}_{ij} = \frac{\Delta x_s}{8\pi} \int_c K(x_i - \xi_j, y_i - \eta_j, z_i - \zeta_j, k, M) d\eta \quad (28.1)$$

In the original DLM, the numerical integration of the kernel function K is based on the quadratic approximation of the numerator as shown in [2]. In the present work, the integration procedures are based on the following procedure: